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Surgical palliation for unresectable hilar cholangiocarcinoma

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Abstract
The majority of patients who present with hilar cholangiocarcinoma will have incurable disease and require only palliation. Efficient relief of disabling symptoms is required with minimal morbidity and mortality and can be achieved by either surgical or non-operative options. A review of the indications, anatomical considerations and surgical techniques is presented. Segment III cholangio-jejunostomy is the most frequently used surgical bypass procedure and in those patients with an expected survival of more than 6 months, surgical palliation offers good quality and long-lasting palliation. There is a need for randomized controlled data to define the optimal role of surgical palliation in this difficult disease.

Introduction

Cholangiocarcinoma is an uncommon malignancy with an incidence in the UK of 2.3/100 000, which is increasing [1]. Hilar cholangiocarcinoma accounts for up to 80% [2] of these tumours and the overall prognosis is poor with a mean survival of 21 months [2]. Despite improvements in preoperative imaging, surgical technique and understanding of the local patterns of spread, an attempted curative resection can only be achieved in 36% of patients [3]. Given that >70% of patients present with jaundice [4,5], a significant proportion of patients will require palliative biliary decompression to relieve their symptoms. Options for palliation consist of either surgical [6–9] or radiological [6,10,11] procedures and both are associated with morbidity and mortality [6–8,10,11]. Controversy exists as to which provides superior palliation [4,6,8] and there are no randomized controlled data to provide guidance. The aim of this review is to discuss indications for palliation, anatomical considerations and surgical techniques involved in palliation of unresectable hilar cholangiocarcinoma and to determine their current role.

Indications for palliation

Hilar cholangiocarcinoma may be considered unresectable because of patient- and tumour-related factors [3]. Unresectability alone does not necessarily imply that palliative intervention is required. The aim of palliation is to optimize the quality and quantity of remaining life, with minimal morbidity (both early and late) and mortality. In those patients who have pruritus or cholangitis, the need for intervention is obvious, but in those who have asymptomatic hyperbilirubinaemia the indications are less clear. In a recent prospective trial [12] using endoscopic stenting for inoperable extrahepatic malignant jaundice, there was an improvement in quality of life scores following biliary decompression, but this was limited to those with a bilirubin of <250 mmol/l. Further data are therefore required before definitive recommendations can be made regarding this issue.

To relieve hyperbilirubinaemia and associated pruritus, it is known that 30–50% of functioning liver needs to be drained [13]. This equates to draining at least segments III and IV and ideally II, III and IV for a left-sided approach and at least two segments if a right-sided approach is being considered. Equally, draining a non-functioning atrophic lobe will not be useful and may well compromise the patient by introducing sepsis. For this reason knowledge of the intrahepatic ductal anatomy is required. If drainage is required for symptomatic cholangitis, draining one lobe in the presence of an isolated infected contralateral lobe will be unsuccessful and bilateral biliary decompression should therefore be undertaken. As with attempted resection, an overall assessment of the patient's preoperative function and ability to withstand surgical intervention needs to be taken into consideration.

Anatomical considerations

Surgical palliation for hilar cholangiocarcinoma can involve anastomoses to the extrahepatic or selected intrahepatic segmental ducts (mainly segment III). The left hepatic duct is extrahepatic in its course and is contained within a peritoneal extension that includes the left portal vein and hepatic artery [14]. This portal

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triad lies under the base of segment IV covered by fusion of Glisson's capsule and peritoneum. The length of the left hepatic duct is proportional to the length of the base of segment IV [14]. It has a mean length of 1.3 cm [15], but in 17% of cases it is <6 mm [16], making it susceptible to tumour involvement in the presence of a hilar lesion. In this transverse segment it is always superior to the portal vein and if there is late union of the left hepatic duct, the segment II duct tends to lie posterosuperiorly and the segment III/IV duct anterosuperiorly before uniting just before the hilum [17]. Having traversed the base of segment IV the triad of structures reaches the umbilical fissure where vessels divide into segmental branches II, III and IV, with the equivalent segmental duct tributaries converging to form the left hepatic duct. The commonest of the described variations occurs in 78–85% of cases when segments II and III join in the umbilical sulcus and segment IV drains at a variable point between this and the confluence of the left and right hepatic ducts [16,17]. In 10–15% of cases the left hepatic duct is duplicated whereby segment III and IV join initially and then converge with segment II at a variable point before the main confluence [16,17]. In this situation if the origin of the left hepatic duct is compromised by tumour, the segments may be isolated rendering surgical drainage of segment III ineffective.

The ligmentum teres enters the umbilical fissure to attach to the lower (64%), middle (15%), or upper (2%) aspect of the junction of the left portal vein as it divides into its segmental branches [15]. It may be bridged by a band of liver tissue which joins segments III and IV. This does not contain any significant structures but may be a guide to underlying aberrant anatomy such as an infra-portal segment III bile duct [18]. Classically the bile ducts are related intimately to the umbilical plate [16] and are the first structures encountered with an anterior approach to the ligamentum. An infra-portal segment III duct (6%) can often be detected by preoperative imaging [18]. The segment III duct is formed from an anteroinferior and posterosuperior duct. The main segment III duct runs adjacent to the left border of ligamentum teres [16] into the umbilical sulcus where it joins with the segment II duct. Thus segment III can easily be exposed by dividing liver tissue to the left of the ligamentum teres; however, if there has been significant hypertrophy of the left lobe in response to right-sided atrophy, the distance required to expose the segment III ducts may be increased [16].

In contrast, the extrahepatic course of the right hepatic duct is much shorter, and because of its close proximity to the tumour does not allow suitable access for surgical bypass. There are no equivalent anatomical guides (ligamentum teres) to the right-sided intrahepatic segmental ducts and intraoperative ultrasound is required to identify dilated segment V or VI ducts [16]. If this approach is to be used knowledge of the right-sided sectoral anatomy is important, as a segmental drainage procedure will drain the whole right lobe effectively in only 57% of cases [16].

Surgical techniques

Initial techniques described the placement of intraoperative stents, or resectional-based intrahepatic cholangioenterostomy; however, these have been superseded by non-resectional hepatico- or cholangiojejunostomy [19]. This forms the basis of the technique described below. Access is established through a left/bilateral subcostal incision. The duodenum and right colon are retracted inferiorly to expose the porta hepatis. The falciform ligament is divided from the anterior abdominal wall back to the point of the triangular ligaments. Division and retraction of the ligamentum teres on a secured ligature facilitates exposure. Intraoperative assessment of the liver is important, as the detection of significant metastatic disease within the left lobe is a contraindication to left-sided drainage.

Left hepatico-jejunostomy Roux-en-Y

Segment IV is retracted cranially to expose the area of the confluence at the base of segment IV. If a bridge of tissue lies across the ligamentum teres joining segment III and IV, this can be divided to improve exposure to the left hepatic duct [14]. To gain access to the left hepatic duct, a plane between Glisson's capsule and the peritoneal extension encasing the portal triad at the base of segment IV requires division. Deepening the dissection will allow the left portal structures to be lowered from the base of segment IV, whereas extension to the right will allow access to the confluence. In the presence of a Bismuth IIIa-IV lesion or a large Bismuth I-II tumour [19] this may not be possible since the tumour may be close to the proposed anastomosis, thereby raising concerns about tumour overgrowth. In this setting it is better to perform an intrahepatic cholangio-jejunostomy.

If the left duct is deemed suitable, it is incised longitudinally for the length of the exposed duct. A retrocolic Roux limb is fashioned from proximal jejunum. A side-to-side single layer interrupted mucosal to mucosal anastomosis is performed using a 4.0 monofilament suture. It may be useful to place two stay sutures at either end of the anastomosis. In placing the anterior row of sutures into the bile duct (leaving the needles attached) as described by Voyles and Blumgart [20], the anterior wall can be elevated to facilitate accurate placement of the posterior sutures. With all the posterior sutures in place the jejunum can be parachuted down to approximate with the bile duct and the sutures tied. In this way, the anterior row can be completed under direct vision.

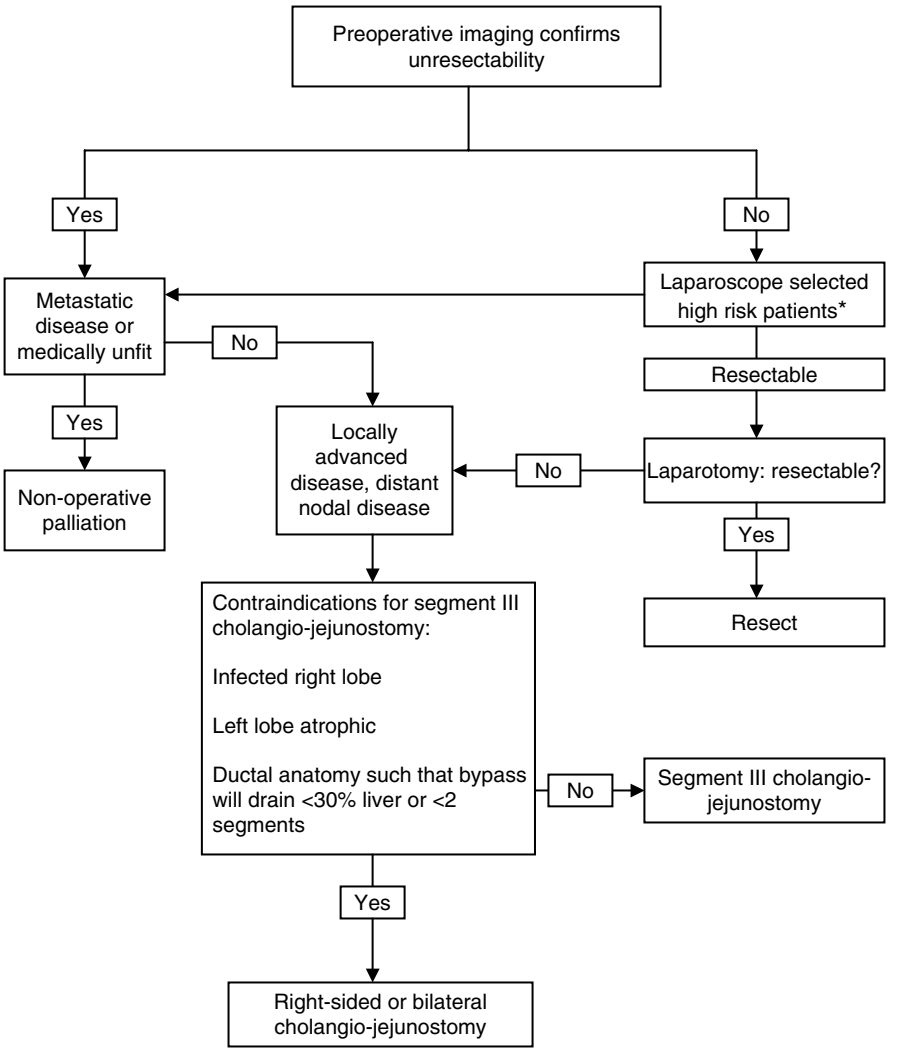

Figure 1. Algorithm for management of hilar cholangiocarcinoma. *Patients defined as high risk by Weber *et al.* [24].

Segment III cholangio-jejunostomy Roux-en-Y

In the event that the left duct is not suitable for drainage an intrahepatic cholangio-jejunostomy, most commonly to segment III, can be performed. The ligamentum teres is retracted caudally and to the patient's right to expose the left border of segment III, which is retracted with segment IV cranially. The superior extensions of the ligamentum teres and the liver tissue adjacent to its left are divided to expose the umbilical plate that contains the segment III duct. The depth of liver tissue which needs to be opened will vary depending on the degree of left lobe hypertrophy but the Cavitron Ultrasonic Surgical Aspirator is ideal for undertaking a 'bloodless' dissection. The split needs to provide sufficient exposure to allow the Roux limb to sit comfortably without creating tension on the anastomosis [16]. We frequently extend the incision to 'saucerize' the liver overlying the segment III duct and this facilitates construction of a larger enteric anastomosis while minimizing kinking of the Roux-en-Y loop [21]. Small vessels are encountered and can be controlled by diathermy or ligation but it is rarely necessary to control the hepatic inflow. With the duct exposed for a 1–2 cm length, an anastomosis is performed without a biliary stent using a similar technique to that described above. It may be necessary to use an end-to-side anastomosis so that the jejunum sits more comfortably within the recess [22].

Right-sided hepatico-jejunostomy Roux-en-Y

For those patients in whom segment III cholangio-jejunostomy is not feasible the remaining options include radiological stenting, right segmental drainage or intraoperative stent placement. Right-sided drainage requires identification of either the right anterior sectoral or segmental ducts (V or VI), which are exposed by a hepatotomy at the base of the gall bladder fossa. The overlying liver parenchyma is divided to expose the anterior sectoral duct longitudinally. In many patients with malignant hilar disease, this will not be easily achieved and intraoperative ultrasound may be required for peripheral identification

Table I. Comparison of patients undergoing palliative treatment for hilar cholangiocarcinoma at the Royal Infirmary, Edinburgh, between December 1987 and March 2002 (unpublished data).

Variable	Non-operative palliation	Surgical palliation	Total	*p* value
Number	125	33	158	
Median age (range)	69 (40–93)	59 (33–78)	67 (33–93)	<0.001
30-day mortality (%)	13 (10)	1 (3)	14 (9)	NS
No. of patients readmitted (%)*	35/110 (32)	10/30 (33)	45/140 (31)	NS
6-month readmission rate (%)*	26/110 (25)	5/30 (17)	31/140 (22)	NS

NS, not significant.
* Denominator given as four patients were lost to follow-up.

of the main segmental anatomy [16]. In those who require bilateral drainage, palliation can be achieved by performing a partial resection of the anterior part of segment IV to expose the ducts draining segment IV and V followed by separate cholangio-enteric anastomoses [23]. All such approaches are more demanding than those to the left side of the liver.

Who should have surgical palliation?

The options for palliation (Figure 1) can be divided into non-operative or surgical bypass. Non-operative biliary decompression (percutaneous transhepatic, endoscopic or combined) can achieve satisfactory short-term results [10,11]. Given the reported high initial success rate and relatively low mortality associated with radiological stenting, it would seem the appropriate first-line approach to those with a life expectancy of <6 months [24] and those unfit for major surgical intervention.

Those patients with locally advanced disease may have a better prognosis [8,24] and may be better served by surgical palliation. Several surgical series show that palliative bypass can be performed with peri-operative mortality and morbidity rates varying between 0–17% and 13–61%, respectively [6–8, 16,23,26–28]. Relief of jaundice can be obtained in 67–100% [7,8,16,23,26] of patients undergoing bypass, results which are comparable to those achieved with radiological stenting [10,11]. Long-term morbidity requiring further intervention is reported in 16–44% of patients [7,8,16,25,26,28].

In our own institution, 201 patients with hilar cholangiocarcinoma were assessed between December 1988 and March 2002 (unpublished data). Thirty-nine (19.4%) underwent resection, 33 (16.4%) surgical bypass, 125 (62.2%) underwent non-operative palliation and in 4 (2%) cases no treatment was offered. The median survival rates (95% confidence intervals) were 20 (12–28), 15 (5–25), 4 (3–5) months, respectively. Comparison of patients who underwent surgical palliation to those having non-operative palliation showed that a younger cohort underwent surgical intervention, but 30-day mortality and readmission rates were similar (Table I).

Several studies have compared survival times for those palliated surgically or treated non-operatively. There are conflicting data within the literature [4,6,25,29] but these studies are non-randomized and the heterogeneity of both patient and tumour factors within and between studies makes any conclusions invalid. Nonetheless, in a study reported by Traynor and colleagues [22], 48 patients were managed over a 25-year period by segment III cholangio-jejunostomy with low morbidity and mortality. Complete or partial relief of jaundice was obtained in 73% and 23% of patients, respectively. Mean duration of survival was 9.2 months and few patients experienced recurrent jaundice or cholangitis [22].

The detection of distant nodal disease at the time of attempted resection raises the issue of whether these patients should undergo cholangio-jejunostomy or an extrahepatic bile duct excision. It has been reported that extrahepatic bile duct excision can be performed with similar morbidity and mortality rates as reported for surgical bypass [3] and offers excellent palliation [30], with the advantage of draining both lobes. Whilst a more radical approach may be considered, there is a propensity for local recurrence [31], thereby rendering such an anastomosis at increased risk of tumour overgrowth compared with a segment III cholangio-jejunostomy.

In conclusion, the majority of patients who are diagnosed with hilar cholangiocarcinoma will require a palliative approach. In those with a predicted life expectancy of <6 months non-operative stenting is the preferred treatment, but those with locally advanced disease are likely to achieve better quality palliation with surgical intervention, which can be performed with similar morbidity and mortality to non-operative techniques. There is a need for randomized controlled data to identify the optimal approach for the various subgroups of patients, particularly with the improvements in endoscopic and radiological prostheses. Such trials must include quality of life assessment since this is ignored frequently in reported series.

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